Faculty of Cognitive Sciences and Human Development

ELECTROENCEPHALOGRAM (EEG) SIGNATURE OF AUTISM SPECTRUM DISORDER (ASD) CHILDREN

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_____ _____

(Date submitted) (Student's signature)

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ELECTROENCEPHALOGRAM (EEG) SIGNATURE OF AUTISM SPECTRUM DISORDER (ASD) CHILDREN

The purpose of this research was to explore, analyse and describe the brainwave pattern of Autism Spectrum Disorder (ASD) children using Quantitative Electroencephalogram (qEEG) and suggesting the right neurofeedback training (NFT) protocol. Quantitative Electroencephalogram primarily measures the electric potential field at the scalp surface. Quantitative Electroencephalogram mapping helped to provide an accurate assessment for placement of protocol as compared to behavioural checklist. Then, the researcher discussed all improvements in terms of behaviour modification in correlation with the changes of brainwave patterns. One of every 150 children born today in Malaysia has Autism (Malaysian Psychiatric Association, 2010). Their numbers are increasing; therefore, it is vital to do research on this disorder to improve the quality of life and reduce stress among parents and caregivers. Although there is no cure, appropriate management such as combination of neurofeedback and traditional method may foster normal development and reduce undesirable behaviours of ASD children. This study involved nine participants who were purposely selected from Kuching Autistic Association (KAA) with a diagnosis of having ASD symptoms by medical specialist. Their brain topography was obtained using qEEG brain mapping. Quantitative Electroencephalogram brain mapping followed by an average of 46 NFT sessions to monitor their brainwave. A neurofeedback protocol was designed to suppress the ratio of Theta and Alpha (4-10 Hz) to Beta (16-20) as well as to train the individual to normalize abnormal EEG frequencies. Neurofeedback protocols changed over time depending on participants' mood, health condition and behaviour during training. Secondary qEEG recordings were made to see any brainwave alteration after neurofeedback training. There were series of observations for all participants before NFT as well as a series of observations after the NFT. Findings from qEEG mapping of this research were categorized under the third sub group - high Delta/Theta waves - as discovered by Michael Linden (2004) in his research on the four subtypes of autism. Quantitative Electroencephalogram discovers a pattern of high delta brainwave at prefrontal and frontal area, insufficient theta, alpha and beta brainwave in most of the brain region of ASD children. With regards to connectivity, main findings showed frontal lobe hyperconnectivity as well as hypoconnectivity of frontal region to other regions of the brain and diminished connectivity in language areas. The second qEEG session shows generally decreased Delta activity in frontal region of the brain, increased of theta, alpha and beta activity at most of the brain regions. The results have shown remarkable improvements in the participant's speech, language, communication, sociability, cognitive and behaviour after five months. This research described that the brain lateralizations of ASD children were different from the brainwave pattern of the normal children and demonstrates the efficacy of NFT to help regulate the abnormal brainwaves and

behaviour and improve the neuronal regulation of the brain as indicated by the normal features of the brainwaves.

ABSTRAK

SIGNATUR "ELECTROENCEPHALOGRAM (EEG)" KANAK-KANAK YANG MENGALAMI GANGGUAN SPEKTRUM AUTISMA

Penyelidikan ini bertujuan untuk mengkaji, menganalisa dan menerangkan pola-pola gelombang otak dalam kalangan kanak-kanak autisma menggunakan "Quantitative Electroencephalogram (qEEG)" serta mencadangkan protocol "Neurofeedback" (NFT) yang sesuai kepada setiap peserta kajian. Pemetaan qEEG dapat memberikan analisis yang tepat mengenai penempatan elektrod and protokol berbanding ujian tingkah laku. Seterusnya, pengkaji membincangkan kesemua peningkatan dari segi perubahan tingkah laku yg berkait rapat dengan perubahan corak gelombang otak. Satu daripada 150 orang kanak-kanak yang dilahirkan di Malaysia hari ini disahkan menghidap autisma (Malaysian Psychiatric Association, 2010). Statistik ini terus meningkat dan kajian tentang permasalahan ini wajar dijalankan untuk meningkatkan kualiti hidup disamping mengurangkan tekanan dalam kalangan ibu bapa dan penjaga. Walaupun tiada rawatan yang boleh menyembuhkan autisma, pengurusan yang bersesuaian seperti kombinasi latihan NFT bersama rawatan konvensional yang lain dapat membantu menggalakkan pertumbuhan yang hampir normal dan mengurangkan tingkah laku yang tidak diingini. Kajian ini melibatkan sembilan peserta yang telah dipilih dari Persatuan Autisma di Kuching, Sarawak yang telah disahkan sebagai kanak-kanak autism oleh doctor perubatan dan pakar kanak-kanak Topografi otak mereka telah diperoleh menggunakan pemetaan qEEG. Langkah ini diikuti dengan latihan "neurofeedback" dengan purata sebanyak 46 sesi seorang bagi memantau gelombang otak mereka. Protokol NFT telah direka untuk mengurangkan nisbah theta dan alpha (4-10 HZ) kepada beta (16-20 HZ) disamping melatih setiap individu untuk mengimbangkan frekuensi EEG yang tidak normal. Protokol NFT berubah mengikut keadaan peserta semasa latihan sepeti emosi peserta, keadaan kesihatan dan tingkah laku. "Quantitative Electroencephalogram" direkod kali kedua untuk melihat sebarang perubahan yang mungkin berlaku selepas latihan NFT. Beberapa siri pemerhatian telah dijalankan sebelum dah selepas NFT. Dapatan dari pemetaan qEEG dalam kajian ini dikategorikan di bawah kumpulan ketiga iaitu gelombang delta/theta yang tinggi seperti yang ditemui oleh Michael Linden (2004) dalam kajiannya berkaitan empat sub jenis autisma. Pemetaan qEEG telah menemui corak gelombang delta yang tinggi di bahagian "prefrontal" dan "frontal", kekurangan gelombang theta, alpha dan beta pada keseluruhan bahagian otak kanak-kanak autisma. Berdasarkan dapatan utama kajian, lobus "frontal" menunjukkan "hyperconnectivity" dan lobus "frontal" kebahagian otak yang lain menunjukkan "hypoconnectivity" dan penyusutan activity pada bahagian bahasa. Pemetaan qEEG yang kedua menunjukkan pengurangan aktiviti delta pada bahagian otak "frontal", peningkatan aktiviti theta, alpha dan beta di keseluruhan bahagian otak. Kajian ini menunjukkan peningkatan yang mengagumkan terhadap bahasa,

komunikasi, kebolehan sosial, kognitif dan tingkah laku sepanjang lima bulan. Kajian ini menerangkan bahawa corak gelombang otak kanak-kanak autisma berbeza daripada corak gelombang otak kanak-kanak normal serta melihat kebolehan NFT untuk mengubah gelombang otak dan tingkah laku serta memperbaiki pengawalan neuro seperti yang ditunjukkan oleh ciri gelombang otak yang normal.